Swami Ramanand Teerth Marathwada University, Nanded

-: Name of the Research Topic:-

"Synthesis, Charecterization of Praseodymium Based Thin Films by Spray Pyrolysis"

Faculty of Science in the subject Physics

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Category - OPEN

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Synthesis, Characterization of Praseodymium Based Thin Films by Spray Pyrolysis

Abstract of proposed work plan/problem:

In this Present Research work simple chemical Spray Pyrolysis method is used for deposition of nano-crystaline Praseodymium chalcogenide based thin films. Thin films produced are characterized by using different characterlization technique such as TEP, SEM, TEM, EDAX, XRD, UV, IR, Photoeletrochemical characterization technique, etc.

It is also planed to study the applications of Praseodymium thin film to society (Solar cell preparation and super capacitor designing, sensors etc.)

Introduction:

In recent years, thin films have attracted much interest due to various applications in manufacturing & designing of Semiconductor devices, Photovoltaic cell, optoelectronic devices, radiation detectors, Laser materials, thermoelectric devices, solar energy convertors

In the field of materials research one is often confronted with problems of materials preparation and in order to reduce cost of a relatively simple method is needed to be able to asses quickly the various physic-chemical properties of the materials. The deposition material properties enhance the importance and utility of thin films in economic way. For preparation and deposition of the films on different substrates by chemical techniques have been studied commonly, those techniques facilitate designing of materials on molecular level. Various deposition techniques have been used for thin film formation, like chemical vapour deposition (CVD), molecular beam epitaxy (MBE), radio frequency magnetron sputtering; successive ionic layer adsorption and reaction (SILAR); spray pyrolysis etc.

Literature Survey:

- **G K Mor [2000]** et al. Studied a metal to insulator transition has been observed in Praseodymium films at room temperature. The band gap of 3.0ev has been obtained for Praseodymium hydride films from reflectance &transmission data

- **T Arokawa[1984]** et al. The films of PrO (0.7-1µm thick) were obtained by depositing Praseodymium (99.9%) on to silica plate of dimension 10mm×15mm in vacuo and oxidizing it in oxygen. This carried out for 1 hour at $870^0$and about 1.33×10^{-3} pa pressure.

  The film resistivity was measured with conventional D.C resistivity technique in temp range 300-870^0 under oxygen at various pressures.

- **M. De Sario[2002]** et al. Praseodymium doped GeS_2, Ga_2S_3Csl thin films were prepared by (PLD) technique Pr^{+3} doped targets in vacuum with Xecl laser. The films were deposited on microscope slide, glass substrate at room temperature. Film characteristics were investigated by different techniques.

- **H.C.Aspinal [2004]** et al. Thin films of Praseodymium oxide have been deposited by liquid injection MOCVD using the volatile Praseodymium Alkoxide. Thin film were grown over a wide range of substrate temperature ($250^0C – 600^0C$)

- **Huankiat Sen [2004]** et al. Langasite [$La_2Ga_3Sio_{14}$] is a piezoelectric material for use in high temperature bulk acoustic wave gas sensor, detecting changes in PrO_2 under oxidizing condition the sensor were operated at 600^0C and showed strong sensitivity to changes in pressure.

  Literature survey reveals that Praseodymium based thin film yet not studied by spray pyrolysis technique

Objective of Research:

It is planed to deposit a Praseodymium chalcogenide thin film on non conducting and conducting substrate by Spray Pyrolysis Method.

The different characterizations such as electrical resistivity, TEP, SEM, TEM, EPAX, SRD, RR, PEC, etc. studied for prepared thin film.

Methodology to be adopted:

The Praseodymium Chalcogenide nanocrystalline thin films are to be deposited by using Spray Pyrolysis method.

The water soluble Praseodymium compound mixed chemically to form Praseodymium chalcogenide aqueous solution. The films are deposited for different concentrations at “different temperature”.

The optical, physical and electrical properties of Praseodymium deposited thin films are to be studied.

Importance of study / society applications:

Praseodymium chalcogenide thin film study is most important because of its electrical, chemical, optical and structural properties which are useful for super capacitor designing, solar cell and energy conservation devices, etc.

As nano crystalline thin films are widely used to increase life and efficiency of solar cell. To develop and designing of highly efficient non conventional energy devices is the present need of nation.

The main problem of energy storage is diluted by designing super capacitor using nanocrystalline thin film.

Proposed work plan / formation and structure of study:

- 2016-17

  During the first year of research work literature survey related to Praseodymium Chalcognide thin film has to be taken. Spray Pyrolysis Technique is designed and studied for Praseodymium Chalcogenide thin film.

- 2017-18

  During second year Praseodymium Chalcogenide nanocrystalline thin film has to be prepared by Spray Pyrolysis technique and their characterization such as electrical resistivity, TEP, SEM, TEM, SPAX, SRD, IR, PEC, UV, Superconducto, etc. proposed to be taken.

- 2018-19

  Plan to analyze the prepared thin film.

  - Result and discussion for proposed plan work has to be discussed. Preparation of final draft (Thesis) for proposed work.

References:

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5. Huankiat Sen, Harry L.Tuller & Holger Fritze (Jule 2004) volume 13(775-778)
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